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ABSTRACT

Intended to enable an individual to converse with satellite antenna dealers and to select a dealer and acquire an antenna to suit his/her needs at the lowest cost, this edited version of a final project report provides detailed guidelines for purchasing of communications satellites distance education delivery systems and specific technical satellite equipment. A list of 21 additional satellite adult education programs is included as well as a glossary of more than 60 important terms used to describe basic satellite technology. (DB)

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" EXPLORING THE AIRWAYS FOR ADULT EDUCATION "

Section 310 Final Report
Fort Smith Adult Education Center
Fort Smith, Arkansas

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During fiscal year 1988 the Fort Smith (Arkansas) Adult Education Center conducted a project entitled "Exploring the Airways for Adult Education". The project, funded under Section 310 of the Adult Education Act, researched the types of equipment and services available to adult educators interested in educational programming by satellite. Some of the information contained in the report will be useful to adult educators. The attached document is an edited version of the project's final report.

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EXPLORING THE AIRWAYS FOR ADULT EDUCATION
Report--310 Project PS-01-88
June 1988

Distance education, teleconferencing, and educational programming by satellite are gradually moving to the forefront in education. If adult education is to be a part of it, now is the time to get in on the "ground floor," so to speak.

The Purchase of Equipment: A Short Course

The purchase of the satellite equipment was not the simple process it would have seemed to be. Because the area of satellite reception is so new, especially to the educational market, most people are not equipped with sufficient knowledge even to ask the right questions.

This "short course" in terms and components should enable an individual to converse with satellite antenna dealers and to select a dealer and an antenna which will best suit his/her needs at the lowest cost.

While commercial grade equipment, i.e., the same as used by cable television networks, may be desirable because of its likelihood of longer-term performance, high-grade home equipment will fit the needs of most schools/school districts very adequately.

Care should be taken, however, to select a reputable dealer who:

(1) carries a major brand of satellite receiving equipment
(2) is knowledgeable about the equipment carried
(3) is likely to continue in business for future service needs
(4) has experience in school installations
(5) is willing to provide proof of equipment specifications
(6) is willing to make an on-site visit to the school to discuss installation and location of receiving site(s)
(7) will install the equipment and provide initial staff training for equipment operation (Handing you a manual is <u>not sufficient</u>!)
(8) will guarantee to service what the company sells; and most importantly will not exceed a maximum of 48 hours (preferably 24 hours) response time should service be required.

These guidelines will help to eliminate those dealers who have just entered the market or those who may prove to be unsuccessful. They also virtually eliminate any vendor who is not in relatively close proximity to you.

In order to be knowledgeable enough to converse when selecting a dealer and a brand or model of equipment, it is also important to keep the following in mind:

(1) A so-called "Earth Station" consists of two basic components: the antenna (often called satellite dish) which is located outside the building, and the receiver/electronics, most of which are located inside the building. In order to receive satellite signals, these two pieces of equipment plus their sub-components are needed.

(2) There are several options with respect to size and type of antenna. Generally speaking, the larger the dish the better reception one can expect.

(3) There are approximately two dozen communications satellites that carry domestic television programs. These satellites are strung along an arc above the Equator high enough so that their orbital speed matches the rotational speed of the earth. Because of their geosynchronous orbit, they appear to remain stationary in the sky; thus we can always receive their signals at the same location relative to earth.

(4) Each C-band satellite has up to 24 transponders (or channels) that receive signals from an "uplink" on Earth and transmit them back again to an earth-based "downlink" (the school).

(5) Satellite signals are in the microwave portion of the radio band, where the waves are "short" enough to be beamed at the satellite's antenna. Most video travels in what is known as "C-band," a portion of the microwave spectrum corresponding to 3700 to 4200 megahertz. This band was assigned to the cable-TV industry years ago.

(6) The future of satellite broadcasting, however, is said to be in "Ku-band," a band which is assigned for commercial satellite use at 12,000 to 18,000 megahertz. Ku-band signals can be made much stronger than C-band signals, so they can be picked up with a smaller-sized dish.

(7) Each satellite has a name such as Westar 4 or Galaxy 3 and a two-character designation like W4 or G3 (which is used to select a satellite for viewing).

(8) Satellite dishes not only have to be large enough to collect the weak satellite signal, but they also need a clear view of the satellite belt in the southern sky, unobstructed by buildings, trees, fences, or foliage.

(9) Potential interference, especially from telephone company or other microwave transmitters, may cause a problem with reception. This is generally more of a problem in urban than in rural areas. You will want, however, to check with your local dealers concerning any known interference problems in the area. (Note: Ku-band reception is not plagued by terrestial microwave interference as are the lower C-band frequencies.)

(10) A recent ruling from the Federal Communications Commission also affects antenna selection. A program to reduce spacing between satellites in orbit from the present 4.0 degrees to 2.0 degrees will take place over the next few years. This means that earth station antennas must become more directional to prevent the reception of signals from two adjacent satellites simultaneously.

(11) A system using a "Low Noise Block Downconverter," sometimes referred to as an LNB, is preferred over a system using the older low-noise amplifier (LNA). Unlike a simple downconverter, the LNB sends all 24 transponder signals at once, allowing viewing of more than one satellite channel at a time, for instance, by a second Receiver and TV. Additional advantages of a block downconverter include cost savings by allowing a less expensive interconnection cable to the receiver and the capability of using longer cable runs, e.g., extending the distance from the receiver to the TV.

(12) While manual adjustment of the satellite dish is possible, it is highly desirable to have a motorized mount, allowing for movement of the dish from the receiver or remote control.

With respect to satellite receiving equipment, one decision which will need to be made is whether you wish to purchase a system with dual capabilities or whether you wish to modify or add additional equipment later in order to receive both bands.

In order to receive Ku-band signals in addition to C-band signals, three equipment specifications must be met: (1) the antenna must be capable of receiving both signals; (2) the receiver must be capable of tuning at both frequencies; and (3) there must be dual feeds mounted on the antenna. It is important to be able to converse somewhat knowledgeably with vendors on this issue. All C-band systems are not Ku-compatible nor are all Ku-compatible systems equally so.

If the decision is reached to purchase a C-band receiving system only, please keep in mind that as air waves become more and crowed, Ku-band transmissions will continue only to increase. At some point it may be necessary either to try to modify your current system or duplicate it with a Ku-band system.

The obvious other alternative is to purchase a system initially which is capable of receiving both C and Ku-band signals.

Enclosures

A mailing list has been developed for further contact regarding programming. A copy of this mailing list is included in this report.

For individuals or schools interested in satellite programming, a basic glossary is enclosed. You have to know the "lingo."

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Glossary of Basic Terms

AD HOC TELECONFERENCE: Refers to a teleconference that uses facilities that are temporarily linked together for a specific meeting or event; implies a one-time or occasional use of teleconferencing as opposed to a permanent system or regular usage.

ALPHANUMERIC: An expression derived from the words alphabetic and numeric which means: "including both numbers and letters."

ANTENNA: A structure which transmits or receives electromagnetic signals.

APERTURE: Same as "diameter" of a parabolic dish antenna.

APOGEE: The highest point in the satellite's orbit--(km).

AUDIOCONFERENCE: Two-way electronic communication, voice only, among three or more indiviudals, or between two or more sites.

AUDIO GRAPHICS: Refers to the transmission of graphics and text information over a narrow band telecommunications channel, such as a telephone line or a sub carrier.

AUDIO-TELECONFERENCING: Two-way electronic voice communication between two or more groups, or three or more individuals, who are in separate locations.

BAND WIDTH: The maximum frequency (spectrum) measured in Hertz or cycles per second, between the two limiting frequencies of a transmission channel; the range of frequencies that can be carried by a transmission medium without undue distortion.

BRIDGE: A device that is designed to interconnect with three or more telecommunication channels, such as telephone lines.

BROAD BAND: Communications channels that are capable of carrying a wide range of frequencies. Broadcast television, cable television, microwave and satellite are examples of broad band technologies. These technologies are capable of carrying a great deal of information in a short amount of time, but are more expensive to use than technologies like telephone which require less band width.

BROADCAST: Transmission of information in one direction that is available to an undifferentiated audience.

BSS: Broadcasting Satellite Systems: Intended for transmission to small home or community receivers.

CABLE TELEVISION: A transmission system that distributes broadcast television signals and other services by means of a coaxial cable. Most cable systems have the potential for two-way communication in addition to broadcast television.

CLOSED CIRCUIT TELEVISION: A transmission system that distributes television programs--live or tape, both audio and video, to a limited network connected by cable. The network may consist of one institution or several. The telecast cannot be received by other television sets outside the selected network. The signal does not have to meet FCC commercial specifications.

COMMUNICATIONS SATELLITE: A satellite in earth orbit which receives signals from an earth station, and retransmits the signal, video and/or audio, to other earch stations.

DBS: Direct broadcasting satellite service.

DEDICATED LINE: Communications circuit used for one specific purpose; i.e., for interactive portion of a teleconference.

DIRECT BROADCAST SATELLITE (DBS): A satellite designed with sufficient power so that inexpensive earth stations can be used for direct residential reception.

DISH: A parabolic antenna that is the primary element of a satellite earth station.

DOMESTIC SATELLITE: A satellite that provides communication services primarily to one nation.

DOWNLINK: An earth station that receives satellite signals.

EARTH STATION: The ground equipment including a dish and its associated electronics used to transmit and/or receive satellite communications signals.

ECHO: The reflections of signal energy that cause it to return to the transmitter or to the receiver

ECHO CANCELLER: A device used in satellite communications to eliminate echo in audio transmission.

END USER: The ultimate consumer of a service.

FACILITATOR: The individual responsible for the local component at a teleconference site. May or may not be an expert in the subject matter.

FEEDBACK: (1) Video - picture distortion caused when a video signal re-enters the switcher and becomes overamplified; (2) Audio - unpleasant howl from the loud speaker, caused when the sound inadvertently is fed into the microphone and is overamplified.

FOOTPRINT: The geographic region on the earth which can easily receive and interpret a signal from a communications satellite.

FREQUENCY: The rate at which a current alternates, measured in Hertz on a telecommunications medium.

FSS: Fixed satellite service. The earth stations are nonmobile. This service generally provides telephone and TV distribution.

GEOSYNCHRONOUS: An orbit whose period exactly matches the Earth's rotation rate (about 24 hours).

GHz: Gigahertz (1,000 MHz).

GIGAHERTZ: A billion Hertz.

HERTZ (Hz): The unit of frequency. One Hertz is equal to one cycle per second. Named in honor of Heinrich Hertz, first to detect such waves in 1983.

HOLLYWOOD SYNDROME: The tendency to base one's video teleconferencing behavior on a model that includes a highly polished presentation rather than interaction and the use of fast-paced visuals for effect rather than substance.

INTERACTIVE MEDIA: Refers to telecommunications channels that allow the two-way exchange of information.

KILOHERTZ: One thousand Hertz (cycles per second).

LNA - LOW NOISE AMPLIFIER: A special amplifier that boosts the satellite signal while contributing a negligible amount of noise.

MB/s: Megabits per second.

MEGAHERTZ: One million Hertz (cycles per second).

OFF-PREMISE SYSTEM: Refers to a teleconferencing room or equipmnt located outside of a user organizations' facility; e.g., a video teleconferencing room operatec by a vendor and available to the public for a fee.

ON-PREMISES SYSTEM: Refers to a teleconferencing room or equipment that is located within the user organization's own facility.

ORBIT PERIOD: The time for the satellite to make one full revolution in its orbit.

PARABOLIC DISH: A satellite antenna, usually bowl-shaped, that concentrates signals to a single focal point. See reflector.

PERIGEE: The lowest point in a satellite's orbit (km.).

RANDOM ACCESS: The ability to select any one of several items in any order; e.g., random access microfiche projector.

REFLECTOR: The antenna's main curved "dish," which collects and focuses signals onto the secondary reflector or the feed.

SCPC: Single channel per carrier.

SCPT: Single carrier per transponder.

SCRAMBLE: Deliberate distortions of information to permit only authorized reception.

SCREEN DENSITY: The maximum number of accessible screen elements in a video display.

SCREEN FORMAT: The number of rows and columns in an alphanumeric display.

SPECIAL EVENT TELECONFERENCING: Refers to a teleconference that uses facilities that are temporarily linked together for a specific event; implies a temporary satellite network for one-way video and two-way audio.

SYNCHRONOUS: Any operation where a series of events takes place under the control of a clocking device; also refers to information that is sent or exchanged at a certain time.

TELECOMMUNICATIONS: The use of wire, radio, optical or other electromagnetic channel to transmit or receive signals for voice, and data communications; communications over distance using electrical means.

TELECONFERENCING: Two-way electronic communication between two or more groups, or three or more individuals, who are in separate locations; includes group communication via audio, audio-graphics, video and computer systems.

TELEPHONE CONFERENCE BRIDGE: A device that is designed to link three or more telephone channels for a teleconference; usually refers to a bridge that provides only dial-up teleconferencing where an operator calls each participant. Contrast to meet-me bridge.

TRANSMISSION CHANNEL: The medium by which a signal is sent and received between separate locations.

TRANSPONDER: A microwave repeater (receiver and transmitter) in a satellite that amplifies and downconverts the frequency of a received band of signals. Domestic communications satellites use either 12 or 24 transponders, which usually ahve a 36 MHz bandwidth.

TURNKEY SUPPLIER: A vendor or contractor that supplies all components and installation services required for an operational teleconferencing system.

UPLINK: An earth station that transmits a signal to a communications satellite.

VIDEO TELECONFERENCING (VIDEOCONFERENCING): Two-way electronic voice and video communication between two or more groups, or three or more individuals, who are in separate locations; may be fully interactive voice and video or two-way voice and one-way video; includes full-motion video, compressed video and sometimes freeze-frame video.

VIDEODISC: A hard disc that stores information in microscopic "pits" indented into the surface; provides a high-capacity storage medium of over 50,000 frames of information; used to store and retrieve video, audio and other information.

VOICE ACTIATED: The ability of a piece of equipment to become activated in responce to the sound of a voice.